J. New York Entomol. Soc. 95(4):547–552, 1987

BIOLOGY AND MATURE LARVA OF *HEMIPIMPLA PULCHRIPENNIS* (SAUSSURE), A PARASITE OF *ROPALIDIA* (HYMENOPTERA: ICHNEUMONIDAE, VESPIDAE)

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Abstract.—The biology and mature larva of *Hemipimpla pulchripennis* (Saussure), are described for the first time. The relationships among the tribes of Pimplinae are discussed with emphasis on the Ephialtini, of which *Hemipimpla* is a member.

Hemipimpla is an Old World tropical genus belonging to the Pimplinae, a large and widely distributed subfamily of usually ectoparasitic ichneumonids. Treated as a subgenus of *Camptotypus* by Townes (1969), it was raised to generic status by Gupta and Tikar (1976). Members of its tribe, the Ephialtini, are recorded as ectoparasitoids mostly of concealed Lepidoptera larva, although some attack spider egg sacs or adults, aculeate Hymenoptera larvae in nests in wood, or Coleoptera larvae. No larvae and only scattered host records are known for *Hemipimpla* and the related genera (*Camptotypus, Zonopimpla, Odontopimpla, Cenodontis, Parvipimpla,* and *Clydonium*) that make up the *Camptotypus* Group (Gauld, 1984; Townes and Townes, 1960). The recent rearing of *Hemipimpla pulchripennis* (Saussure) from a nest of *Ropalidia formosa* (Saussure) [Vespidae: Polybiinae] is the second time a species of *Hemipimpla* has been reared from a social vespid and allows its larval morphology to be described for the first time.

A source of potential confusion for the reader is the unsettled situation regarding tribal nomenclature in the Pimplinae. Without going into an extensive discussion, the nomenclature of Gauld (1984) is used herein. His Ephialtini is the equivalent of the Pimplini of Townes (1969), Short (1978), and Carlson (1979). The Ephialtini of Finlayson (1967a) includes tribes kept separate by the above authors (Delomeristini, Neoxoridini, Polysphinctini, and Rhyssini). Pimplini *sensu* Gauld is the equivalent of the Ephialtini of Townes (1969), Short (1978) and the Ecthromorphini of Carlson (1979).

Voucher specimens of *R. formosa* and *H. pulchripennis* are deposited in the Snow Entomological Museum, University of Kansas, Lawrence, Kansas. The biology section was written by R. W. Brooks and the larval description by D. B. Wahl.

BIOLOGY

On 7 November 1984, three active (nos. 2, 3, 5; Fig. 1) and two inactive (nos. 1, 4) nests of *Ropalidia formosa* were collected under the eave of a window of a storage building in the Parc de Tsimbazaza, Antananarivo, Madagascar. Each nest had a single female. Nests were put into sealed boxes and checked at irregular intervals.

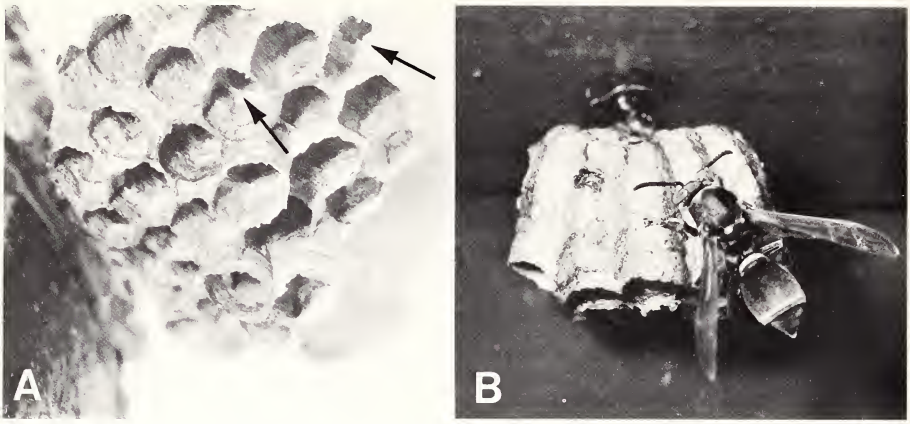

Fig. 1. Nests of *Ropalidia formosa.* A. Nest no. 3 with arrows showing remnant of silken cap spun by *Hemipimpla pulchripennis.* B. *R. formosa* foundress sitting on nest no. 2.

The three nests of *R. formosa* were 2–2.5 cm wide and about 1.5 cm high (Fig. 1). Figure 2 illustrates the condition of each cell. Nest no. 2 had seven cells, two of which were just initiated (3–4 mm high) and the others sealed. On each day, 8 and 9 November, a female *H. pulchripennis* emerged. Sometime during January 1985, a male of the same species was found. Examination of the last two sealed cells showed a dead host adult and a female *H. pulchripennis.* Altogether, four ichneumonids and one host emerged from nest no. 2. Nest no. 3 had 11 cells with host eggs: two cells had a single egg, five cells had two eggs each, and four cells had three eggs each. Two cells were empty and something had apparently emerged from them. Three cells were sealed. From one of the latter, a female *H. pulchripennis* emerged sometime in January 1985. Three of the cells in the nest showed white silken caps (Fig. 1A, arrows) similar to those shown by Keeping and Crewe (1983) and those made by other ichneumonid species. When a host cap is present on a parasitized cell, the ichneumonid silk cap is visible underneath upon dissection.

Adults of *H. pulchripennis* were fairly common diurnally and over a two week period in October four were seen flying about shrubbery in the shade. About two dozen specimens were trapped in four malaise traps in the Parc de Tsimbazaza.

Keeping and Crewe (1983), from 62 colonies of *Belonogaster juncea colonialis* Kohl and *B. petiolata* (De Geer) in the Transvaal, found three nests parasitized with *Hemipimpla apicalis* (Brulle) and two nests with *Anacamptomyia* sp. (Diptera: Tachinidae). They found *H. apicalis* to be an early season parasite and *Anacamptomyia* to parasitize late in the season. Richards (1969) and Crosskey (1981) have also reported *Anacamptomyia* attacking colonies of *Ropalidia.* From my small sample I have also found *H. pulchripennis* to be an early season (October) parasite and an undescribed species of *Anacamptomyia* (N. E. Woodley, pers. comm.) to be a late season (February) parasite. The latter record is from a nest collected by J. Wenzel. In agreement with Keeping and Crewe, I found *H. pulchripennis* to be either a prepupal or pupal parasite as evidenced by the cell height and remnants of the host pupal cocoons. Only one adult *H. pulchripennis* emerged from each host cell since

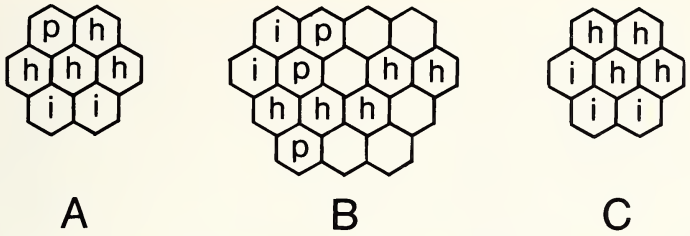

Fig. 2. Contents of nests of *Ropalidia formosa*. A. nest no. 2. B. Nest no. 3. C. Nest no. 5. p = remnant of white silken cap of *Hemipimpla pulchripennis*; h = host pupal silk evident; i = partially completed cell with host egg or eggs.

one ichneumonid head capsule was found per cell. All parasitized cells were close to the nest pedicel, that is, they were the first or nearly the first cell constructed.

Except for the host records of Keeping and Crewe (1983), previously reported hosts of *Hemipimpla* and the closely related *Camptotypus* are Lepidoptera. Seyrig (1932) reared an undetermined Malagasy *Hemipimpla* from an unknown species of pyralid. This species of *Hemipimpla* was a pupal parasite and fed rapidly on a rather darkened and decayed host. From eclosion of the ichneumonid egg to cessation of feeding was less than five days. The mature larva then spun a cocoon inside the cocoon of the caterpillar and emerged as an adult 16 days later. *H. pulcher* has been reared from a drepanid, *Epicampoptera andersoni* (Tams) (Townes and Townes, 1973). *Camptotypus arianus* (Cameron) was reared from the Indian Teak Moth, *Hyblaea puera* Cramer [Hyblaeidae] (Gupta and Tikar, 1976). Another genus in the *Camptotypus* group of genera, a species of *Claydonium*, has been reared from *Pseudomopsis peckolti* (Costa-Lima) [Curculionidae] (Townes and Townes, 1966).

MATURE LARVA OF *HEMIPIMPLA PULCHRIPENNIS*

Figure 3 illustrates the cephalic sclerite and an anterior spiracle of the mature larva of *Hemipimpla pulchripennis*; the specimen was reared from *Ropalidia formosa* (nest no. 3) collected in Antananarivo, Madagascar, 7 November 1984, by R. W. Brooks. Methods of preparation are those given in Wahl (1984). The terminology of the cephalic sclerites is that of Finlayson (1975) and Short (1978) except that *length of mandible* is here used for "full width of mandible."

Description. Cephalic sclerites strongly to moderately sclerotized. Epistoma incomplete medially. Pleurostoma broad. Hypostoma laterally expanded for almost entire length, its margins irregular in outline; hypostomal spur about 1.9× as long as basal width, meeting stipital spur at its medial tip. Stipital sclerite reduced, about 0.4× as long as hypostoma. Labral sclerite present. Labial sclerite roughly triangular in shape, lateral arms fused dorsally; ventral margin without lobes. Silk press in form of transverse slit. Prelabial sclerite absent. Maxillary and labial palpi each bearing one oval and one crescentic sensillum. Mandibular base large; blade about 0.5× as long as mandible, upper and lower edges with fine teeth. Antenna papilliform. Spiracle with closing apparatus adjacent to atrium; atrium goblet-shaped with large opening. Skin with numerous small round protuberances and widely scattered small setae.

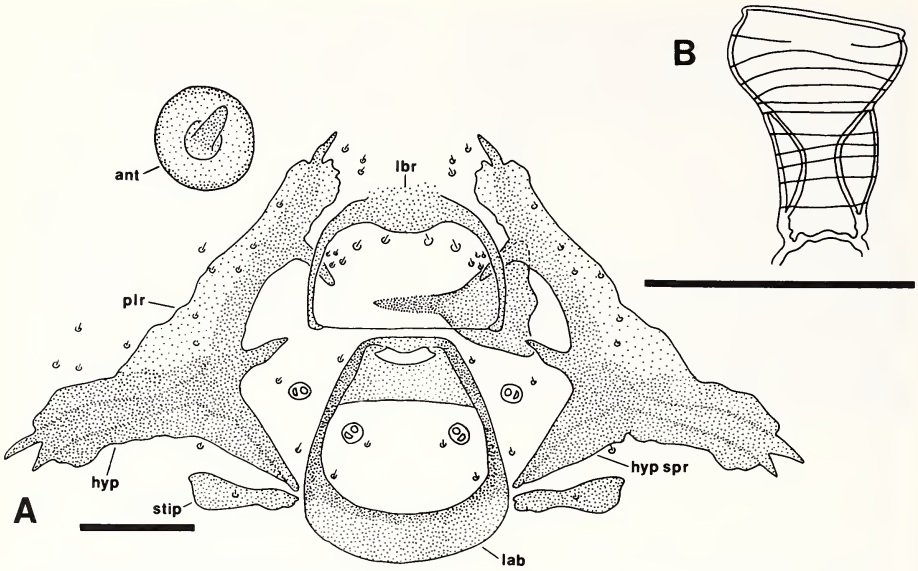

Fig. 3. Mature larva of *Hemipimpla pulchripennis*. A. Cephalic sclerites. B. Spiracle [*ant* = antenna, *lab* = labial sclerite, *lbr* = labral sclerite, *hyp* = hypostoma, *hyp spr* = hypostomal spur, *plr* = pleurostoma, *stip* = stipital sclerite]. Scale bars = 0.1 mm.

The parasitoid's larval remains were found within the host cell. A white silk cap near the anterior end of the cell was the only indication of any cocoon-spinning activity.

Discussion. In the following section, hypotheses of character polarity were determined by outgroup comparison. The Pimplinae are apparently the sister-group of an unnamed lineage consisting of the Acaenitinae, Oxytorinae, Diplazontinae, and Orthocentrinae (Wahl, 1986, and unpubl. data). As there is no general phylogeny for ichneumonids, further outgroup comparison consisted of a survey of the family.

Of the thirty-one genera presently included in the Ephialtini, the mature larva is known for only thirteen (Short, 1978), primarily from the Nearctic or western Palearctic. The larva of *Hemipimpla* is remarkable among ephialtines for the relatively wide pleurostoma and the extensive lateral expansion of the hypostoma (present for almost the entire length of the structure). Ephialtines other than *Hemipimpla* usually have any lateral hypostomal expansion restricted to a smaller portion of the hypostoma and almost never exhibit the irregular margins found in this species.

The relationships among the seven currently recognized tribes of the Pimplinae (Ephialtini, Polysphinctini, Pimplini, Delomeristini, Diacritini, Neoxoridini, and Rhyssini—Gauld, 1984) are unclear. Finlayson (1967a) separated the subfamily into two tribes, the Pimplini and Ephialtini, on the basis of larval characters. Her Ephialtini (containing all the taxa treated as tribes by Townes except for the Pimplini) is unnatural since, in retrospect, it is defined by plesiomorphic characters. While the Diacritini, Neoxoridini, Pimplini, Polysphinctini and Rhyssini appear to be monophyletic groups on the basis of adult and/or larval characters (larvae of Diacritini are unknown), their relationships to one another and to the Delomeristini and Ephial-

tini are uncertain. Gauld (1984) states that the Delomeristini are probably paraphyletic. The delomeristines for which the larvae are known share a striking character with the Rhyssini: a large tooth-like projection at the mandibular base. It should be noted that the projection in *Delomerista diprionis* Cushman (Short, 1978) and *novita* Cresson (Finlayson, 1967b; Short, 1978) does not resemble the character found in *D. japonica* Cushman and the remaining delomeristines and rhyssines. Various projections are found at the mandibular bases in pimplines as well, but by their appearance and location do not seem to be homologous with those of the above two tribes. Townes and Townes (1960) pointed out that the Polysphinctini is a specialized off-shoot of the Ephialtini, thus rendering ephialtines paraphyletic; they may be so with respect to other tribes as well, according to Gauld (1984). The synapomorphy of a hypostoma with some degree of lateral expansion, however, appears to delimit a group within the Ephialtini, one that consists of *Hemipimpla* and six other genera (*Acropimpla, Gregopimpla, Iseropus, Scambus, Sericopimpla,* and *Zaglyptus*). A number of these genera share adult and larval synapomorphies with polysphinctines (Short, 1978; Townes and Townes, 1960), including a laterally expanded hypostoma in most polysphinctines.

Hemipimpla's dorsal fusion of the lateral arms of the labial sclerite is also present, in at least some species of ephialtine genera. This character, although derived, is apparently present in some Rhyssini and Delomeristini. The phylogenetic significance of the character must await further analysis. *Hemipimpla* is, so far as known, unique for the expanded juncture between the lateral arms of the labial sclerite.

ACKNOWLEDGMENTS

Our thanks go to C. D. Michener, W. Wcislo and J. Wenzel (University of Kansas) and W. R. M. Mason (Biosystematics Research Institute, Agriculture Canada) for discussion and criticism of the paper. Wenzel graciously mapped the *Ropalidia* nests and was of great help in interpreting their patterns of parasitism, as well as supplying a tachinid reared from a nest in February 1985. We are indebted to J. Carpenter (Museum of Comparative Zoology, Harvard University) and N. E. Woodley (Agricultural Research Service, USDA) for the respective identifications of *Ropalidia formosa* and *Anacamptomyia.* Collecting by Brooks in Madagascar was supported by a grant from the National Geographic Society (to C. D. Michener) to study the Apoidea of Madagascar and made possible by Dr. Voara Randrianasolo of the Parc de Tsimbazaza. Preparation of the manuscript was facilitated by National Science Foundation Grant BNS82-0065 (C. D. Michener, principal investigator).

This is contribution no. 1977 from the Department of Entomology, University of Kansas, Lawrence, KS 66045.

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Received March 10, 1987; accepted June 8, 1987.